

CLAIMS

WHAT IS CLAIMED IS:

1. An ink delivery regulation apparatus, comprising:
a support configured to be positioned within an ink chamber; and
a resilient deflection member coupled to said support, said resilient deflection member being configured to resiliently deflect from a generally concave shape to a generally convex shape in response to a change in said negative pressure.
2. The apparatus of claim 1, wherein said support is configured to sealingly engage said ink chamber.
3. The apparatus of claim 2, wherein said resilient deflection member is configured to contain an ink in said ink chamber.
4. The apparatus of claim 1, wherein said resilient deflection member comprises first, second, and third pressure tuned panel portions.
5. The apparatus of claim 4, wherein said second panel is coupled to said support, said second panel being initially at a first angle relative to said first panel, at a second angle relative to said support, and at a third angle relative to said third panel.
6. The apparatus of claim 1, wherein said deflection member comprises an elastomeric material.
7. The apparatus of claim 6, where said elastomeric material comprises EPDM/Butyl.

8. The apparatus of claim 9, wherein said resilient deflection member is of substantially uniform thickness.

9. An ink delivery apparatus, comprising:
an ink chamber; and
a pressure regulation member having a support configured to be positioned within said ink chamber and a resilient deflection member coupled to said support, said resilient deflection member being configured to resiliently deflect from a generally concave shape to a generally convex shape in response to a change in said negative pressure.

10. The apparatus of claim 9, further comprising a plurality of said pressure regulation members.

11. The apparatus of claim 9, further comprising a plurality of ink chambers.

12. The apparatus of claim 11, further comprising a plurality of pressure regulation members associated with each of said chambers.

13. The apparatus of claim 11, wherein said plurality of ink chambers is configured to contain a plurality of differently colored inks.

14. The apparatus of claim 9, wherein said apparatus comprises an off-axis ink supply.

15. The apparatus of claim 9, wherein said apparatus comprises an on-axis ink supply.

16. The apparatus of claim 9, further comprising a fitment associated with said ink chamber.

17. The apparatus of claim 16, wherein said fitment further comprises a fluid interconnect.

18. The apparatus of claim 17, wherein said fluid interconnect is configured to fluidly couple a print head and said chamber.

19. The apparatus of claim 18, wherein said fluid interconnect comprises foam and a screen.

20. The apparatus of claim 18, wherein said fluid interconnect comprises a septum.

21. The apparatus of claim 18, further comprising a second fluid interconnect.

22. The apparatus of claim 21, wherein said second fluid interconnect is configured to transmit ink to said chamber and further comprising a plug disposed in said second fluid interconnect.

23. The apparatus of claim 18, wherein said fitment is configured to couple with a print head.

24. The apparatus of claim 16, further comprising a bubble generator associated with said chamber.

25. The apparatus of claim 24, wherein said bubble generator is configured to limit said negative pressure within said chamber to a pressure equivalent to about 6" of water column during an operational period of said apparatus.

26. The apparatus of claim 25, wherein said bubble generator is disposed in said fitment.

27. An ink delivery apparatus, comprising:
a plurality of ink chambers; and
an integral pressure regulation assembly having a plurality of pressure regulation members corresponding to said plurality of ink chambers
wherein each pressure regulation member is configured to be positioned within each of said plurality of ink chambers and includes a support and a resilient deflection member coupled to said support, said resilient deflection member being configured to resiliently deflect from a generally concave shape to a generally convex shape in response to a change in said negative pressure.

28. The apparatus of claim 27, wherein said integral pressure regulation assembly is integrally formed.

29. The apparatus of claim 28, wherein said integral pressure regulation assembly is configured to be integrally coupled to a plurality of said ink chambers.

30. The apparatus of claim 29, wherein said plurality of ink chambers is configured to contain a plurality of differently colored inks.

31. The apparatus of claim 30, wherein said apparatus comprises an off-axis ink supply.

32. The apparatus of claim 27, wherein said apparatus comprises an on-axis ink supply.

33. The apparatus of claim 27, further comprising a fitment associated with said ink chamber.

34. The apparatus of claim 33, wherein said fitment further comprises a fluid interconnect.

35. The apparatus of claim 34, wherein said fluid interconnect is configured to fluidly couple a print head and said chamber.

36. The apparatus of claim 35, wherein said fluid interconnect comprises foam and a screen.

37. The apparatus or claim 35, wherein said fluid interconnect comprises a septum.

38. The apparatus of claim 35, further comprising a second fluid interconnect.

39. The apparatus of claim 38, wherein said second fluid interconnect is configured to transmit ink to said chamber and further comprising a plug disposed in said second fluid interconnect.

40. The apparatus of claim 35, wherein said fitment is configured to couple with a print head.

41. The apparatus of claim 33, further comprising a bubble generator associated with said chamber.

42. The apparatus of claim 41, wherein said bubble generator is configured to limit said negative pressure within said chamber to a pressure equivalent to about 6" of water column during an operational period of said apparatus.

43. The apparatus of claim 42, wherein said bubble generator is disposed in said fitment.

44. A printing device, comprising:
an ink chamber; and
a pressure regulation member having
 a support positioned within said ink chamber;
 a resilient deflection member coupled to said support, said resilient deflection member being configured to resiliently deflect from a generally concave shape to a generally convex shape in response to changing negative pressure;
 a fitment coupled to said ink chamber;
 a bubble generator in communication with said ink chamber;
 a print head coupled to said ink chamber.

45. The device of claim 44, wherein said resilient deflection member comprises first, second, and third pressure tuned panel portions.

46. The device of claim 45, wherein said second panel is coupled to said support, said second panel being initially at a first angle relative to said first panel, at a second angle relative to said support, and at a third angle relative to said third panel.

47. The device of claim 44, wherein said bubble generator is configured to provide a substantially constant pressure equivalent to about 6" of water column.

48. The device of claim 47, wherein said range is substantially equivalent to pressures of between about 3" and 7" inches of water column.

49. The device of claim 44, further comprising a plurality of chambers.

50. The device of claim 49, wherein said plurality of chambers comprises three chambers.

51. The device of claim 50, wherein said plurality of chambers comprises a plurality of differently colored inks, each contained within one of each of said plurality of pressure tuned ink chambers.

52. The device of claim 51, wherein said fitment further comprises first and second fluid interconnect, said first fluid interconnect being configured to fluidly couple a print head and said chamber, and said second fluid interconnect being configured to fluidly couple an ink supply and said chamber.

53. The device of claim 51, wherein said apparatus comprises an off-axis ink supply.

54. The device of claim 51, wherein said apparatus comprises an on-axis ink supply.

55. A method of delivering ink, comprising:
providing an ink chamber containing an ink and wherein is disposed a deflection member;
establishing a negative pressure in said chamber;
supplying said ink to print head;
regulating a level of said negative pressure within a pre-determined range during said supplying of said ink by resiliently deflecting said deflection member in response changes in said negative pressure.

56. The method of claim 55, wherein said regulating step further comprises resilient deflecting said deflection member between a generally concave shape to a generally convex shape.

57. The method of claim 55, further comprising providing a plurality of said chambers wherein are disposed a plurality of said deflection members in each of said chambers.

58. The method of claim 57, wherein each of said plurality of said chambers is configured to contain a differently colored ink.

59. The method of claim 55, further comprising using an internal pressure source.

60. The method of claim 59, wherein said internal pressure source comprises a bubble generator.

61. The method of claim 60, wherein said bubble generator is tuned to pressure equivalent to about 6" of water.

62. The method of claim 55, wherein said step of establishing said negative pressure comprises applying a positive pressure to said deflection member during a filling step, and removing said positive pressure at an end of said filling step.

63. The method of claim 55, wherein said step of establishing said negative pressure comprises removing a small amount of said ink.

64. The method of claim 55, further comprising moving said ink chamber with said print head.

65. An ink delivery system, comprising:
containing means for containing a supply of ink for a print head;

means for establishing a negative pressure in said containing means;
and

means for maintaining said negative pressure within a predetermined range comprising flexible means for flexing in response to changes in said negative pressure.

66. The system of claim 65, further comprising means for monitoring said negative pressure.

67. The system of claim 65, further comprising means for notifying a user of a sudden increase in said negative pressure that indicates said containing means is operationally empty.

68. The system of claim 65, further comprising means for providing positive pressure in said containing means.